



9X219, 9X228 TYPE 1 OWNERS MANUAL

G12-583

06/01/2016



SAFETY INSTRUCTIONS

This is an industrial component. Only a qualified systems integrator should be allowed to design it into a system. The integrator must determine proper plumbing, mounting, driveline and guard components.

Improper installation or use could lead to a serious, even fatal, accident. The system integrator must communicate all safe operation procedures to the end user(s).

Before operation, fully understand and follow the instructions shown in this manual and any instructions communicated by the system integrator. No one should be allowed to operate or maintain this pump that has not been fully trained to work safely according to the configuration of the pump system and in accordance with all applicable government and industry regulations.

DO NOT paint over nameplates, ID tags or warning tags.

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RECORD INFO FROM PUMP NAMEPLATE DATA HERE:

MODEL:

SPEC:

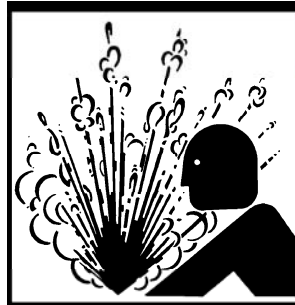
TYPE:

SERIAL:

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1. WARNINGS & GENERAL GUIDELINES



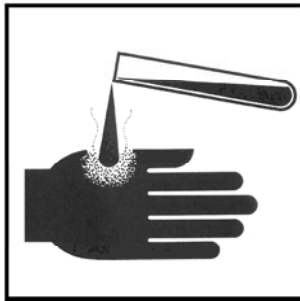
! WARNING

Over-pressure may burst pump or system components. Always include a relief valve in installation. Do not over pressurize pump or block discharge line while operating.



! WARNING

Injection Hazard: Do not try to stop a leak with your hand! Avoid any close contact with hydraulic fluid jets. Escaping fluid can penetrate skin, causing serious injury. In case of accident, seek medical attention immediately for removal of fluid.



! WARNING

Hazardous or Toxic fluids can cause serious injury.



Roper XERIC™ pumps have the distinct advantage of being able to run dry without damage. Nevertheless, minor residue of certain pumped liquids remaining within the pump could vaporize or flash if sufficiently high temperatures are reached. Therefore, it is recommended not to run the pump dry for a period in excess of ten minutes. Allow the unit to air or liquid cool prior to subsequent dry running.

WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

NOTICE: These are general guidelines and do not cover all possible situations. It is the responsibility of the system integrator to apply this product properly.

- **System Pressure & Hazardous Fluids**

1. Disconnecting fluid or pressure containment components during pump operation can cause property damage, serious personal injury, or death.
2. Failure to relieve system pressure prior to performing pump service or maintenance can cause property damage, serious personal injury or death.
3. If pumping hazardous or toxic fluids, system must be flushed and decontaminated, inside and out, prior to performing service or maintenance.

- **Plumbing**

1. The inlet pipe should be as short and straight as possible to minimize suction pressure losses. Excessive restrictions at the inlet can cause cavitation resulting in poor performance, noise, vibration, or pump damage.
2. Slope the inlet plumbing appropriately to avoid air pockets.

3. Plumbing weight, misalignment with the ports or thermal expansion can exert excessive force on the pump. Plumbing must be properly supported and aligned with expansion joints, if required, to minimize these forces.
4. To prevent over pressure situations, install a relief valve as close to the pump outlet as possible. Install the relief valve before any shut-off valves.

DO NOT use Thread Seal (Teflon®) tape on pump port threads.

Teflon® is a registered trademark of E.I. DuPont de Nemours Co., Inc.



WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

- **Mounting Base**

1. Mount the unit on a rigid, heavy base to provide support and absorb shock. Bases should be designed for high rigidity; not just strength.
2. The pump feet were not designed for mounting to concrete and do not have enough contact area to prevent concrete from failing. When mounting to cement or concrete, use a steel baseplate to distribute the mounting stress over an area large enough to prevent the cement from failing. Grout it in place.

- **Pump and Drive Assemblies**

1. Assure adequate guards have been installed to prevent personnel contacting moving components.
2. Follow all OSHA, Federal, State, and local codes.

- **Check Alignment of Pump to Driveline**

Excessive misalignment can overload the pump input shaft and cause premature failure. The figures below show parallel and angular misalignments.

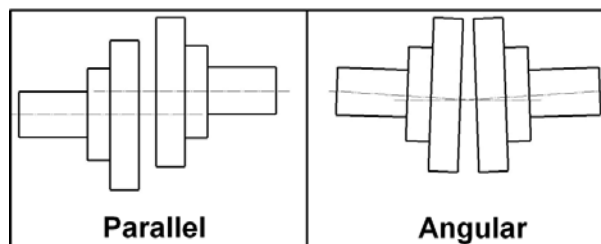


Figure 1-1: Coupling Alignment

- **Roper Pump Company Close Coupled Drives**

The hydraulic or gearmotor units mount directly to the pump.

- o Alignment between pump and driveline is maintained by the assembly.

Because the assembly absorbs reaction forces of the driveline, the mounting base does not need to be as robust. The level of rigidity and strength is determined by the piping stresses from the system.

- **Guarding PTO Drive Shafts**

PTO drive systems can be dangerous and when used, additional safety precautions, including guarding, is required and must be provided by the drive system installer. Roper Pump Company has no responsibility for recommending or providing proper guarding or other safety measures in any particular application.

NOTICE: The installation of proper guards for the power take-off and its associated equipment is the responsibility of the drive system designer and the installer who knows the particular product application and the user's exposure to danger. *The ultimate responsibility for the safe application and installation is the user's.*

WARNING: Failure to stop the pump before adjusting the shaft packing can cause serious injury or death.

2. NAMEPLATE DATA

Roper Pump Company identifies each pump manufactured by a metal nameplate attached to the pump. This nameplate describes the pump as built at the factory. Copy the nameplate data from your pump in the area provided on the front page of this manual. Use this for ready reference when ordering repair parts or when consulting with a Roper distributor or Roper Pump Company about this pump.

WARNING: DO NOT paint over any nameplates, ID tags, or warning tags attached to the pump.

PUMP NOMENCLATURE

MODEL 92205*GHH

SPEC xxxxxx **TYPE** 1

SERIAL NO. xxxxxx

- * The letter "M" may be used in this space indicating the pump is mounted (on a base or bracket) with or without motor.

1. The Model Number consists of a five or six digit number followed by a four letter material code.
 - The first digit (9) indicates the Metal on Metal progressing cavity pump series.

- The second digit (2) indicates the number of stages of pumping elements.
- The third digit (2) indicates the drive size or configuration.
 - 2 – Standard drive, pin joint construction
 - 3 – One drive size larger than standard drive, pin joint construction
 - 4 – Standard drive, gear joint construction
 - 5 – Solid shaft, pin joint construction
 - 6 – Two drive sizes larger than standard drive, pin joint construction
- The fourth, fifth, and (where appropriate) sixth digits (05) indicate the approximate theoretical displacement in U.S. gallons per 100 revolutions.

4 th , 5 th , 6 th digits	025	01	02	05	12	19	28	44
Gal./100 Rev.	.25	1	2	5	12	19	28	44

- The three letters (GHH) indicate the materials of construction. The first letter (G) indicates the pump body. The second letter (H) indicates the internals. The third letter (H) indicates the stator.

Item	Letter	Material
Pump Body	G	A48 Class 25 cast iron
	N	CF-8M stainless steel
Internals	H	Alloy steel, hard chrome plated rotor and shaft
	N	316 stainless, hard chrome plated rotor and shaft
Stator	H	High strength Alloy steel tube and profile

NOTE: The preceding description of the figure number is to assist in identifying your Roper progressing cavity pump only. **DO NOT** attempt to derive any ratings or performance from the figure number. **DO NOT** use the explanation of the figure number to construct your own pump. Not all combinations are possible. For assistance in pump selection, it is recommended that you consult Roper Pump Company or an authorized distributor.

2. Occasionally, special pumps or configurations are required which are unique for a particular application. These modifications are clarified by a SPECification number. Identification of any items different than a standard pump can be made by consulting Roper Pump Company or an authorized distributor.
3. The TYPE number is a number used by Roper Pump Company for in-house identification of construction and hydraulics. Always include the type number in any references to the pump.
4. The SERIAL number is a unique number assigned to each pump built by Roper Pump Company.

In any communication concerning this pump, always be sure to include the Figure, Spec, Type, and Serial numbers so proper identification of the pump can be assured.

3. MAXIMUM PRESSURE RATINGS

Figure 3.1 shows the maximum allowable differential pressure (the amount of pressure difference between the inlet and discharge of the pump) for various durometer stators and stages of the pump. These values are the maximum allowable and are not recommended for every application. Abrasive fluids should not normally be pumped at these maximum values due to the shortened life of the rotor and stator that will occur. Refer to Roper Pump Company's progressing cavity pump technical literature for additional information on recommended pressure limitations for pumping abrasive products.

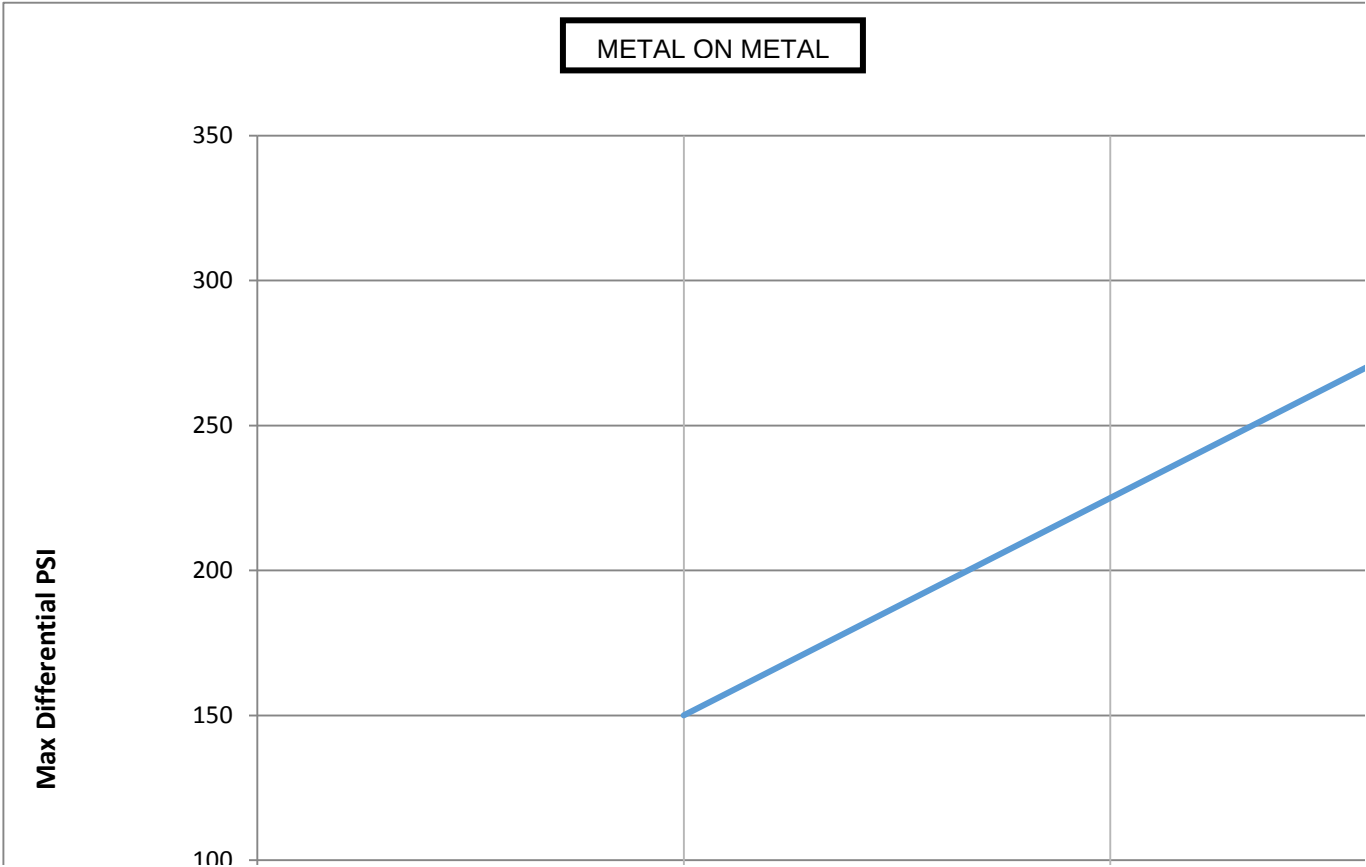


Figure 3.1

Figure 3.2 shows the maximum non-shock pressure rating of the pump inlet body against temperature. Regardless of the number of stages of the pump or the direction of rotation, the values shown in Figure 3.2 must not be exceeded on the inlet body of the pump.

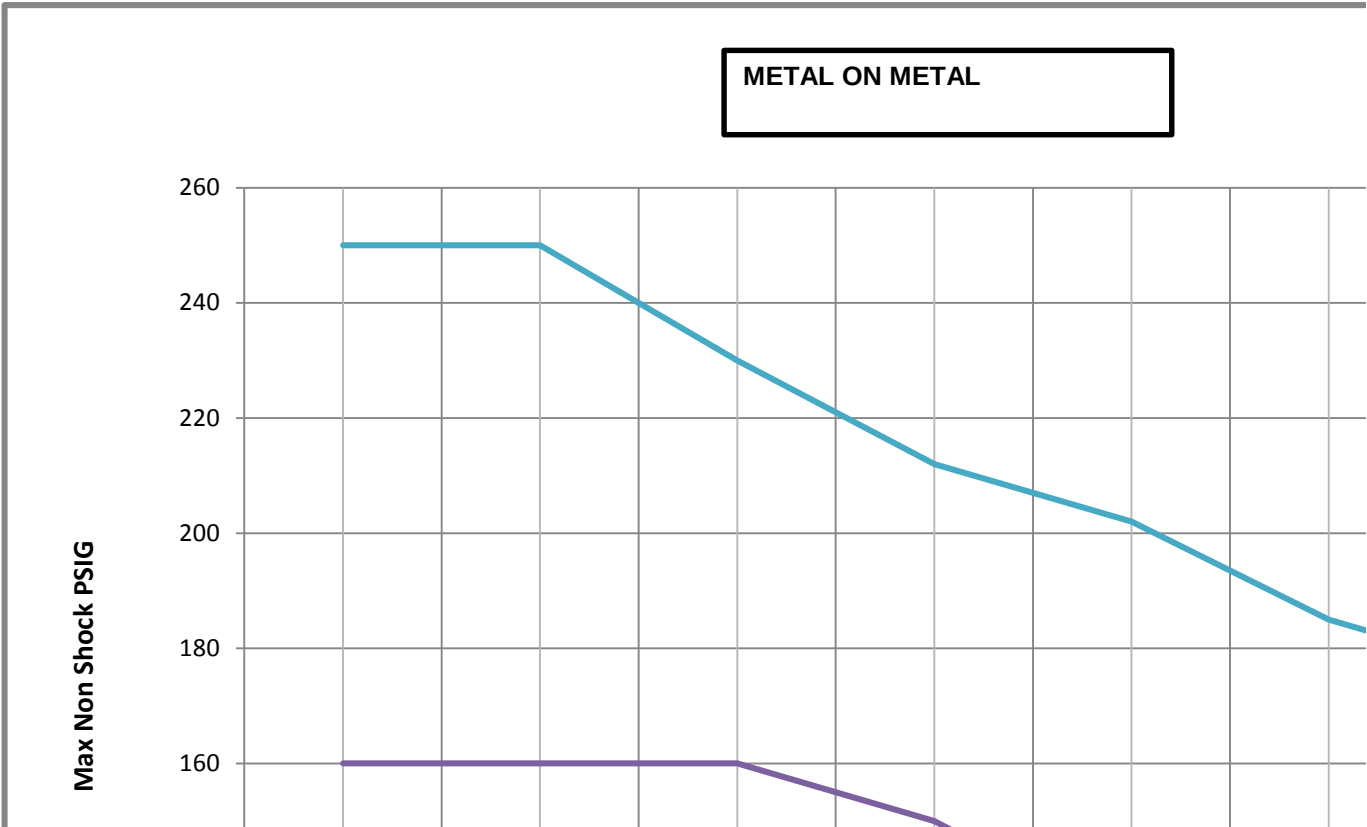


Figure 3.2



! WARNING

Exceeding the values shown in Figure 2.2 may cause physical damage, loss of product, injury to personnel or death. DO NOT extend or exceed the curves shown in Figure 3.2

4. PREOPERATION CHECKS

Read and understand the instructions and recommendations contained in this manual.

Disconnect the coupling between the driver and pump.

This pump was tested at the factory with hydraulic oil and can have a light layer residing inside the stator.

Test the rotation of the driver to make sure it will operate the pump in the desired direction of rotation. Normal rotation is indicated on the pump drive end. The driver rotation test must be done with the driver and pump disconnected. **DO NOT run pump dry for long period. Dry operation is harmful to the pump if not equipped with cartridge seal.**

Before the initial startup, some of the fluid to be pumped should be introduced into the inlet body to insure wetting of the pumping elements. (On subsequent startups, if the pump does not discharge fluid after it has been operating for one minute, it should be re-primed.) Turn on the flush liquid to the packing, if applicable.

Before starting, make sure all guards are in place and the inlet and discharge valves are opened.

After starting the unit, check to see that the pump is delivering liquid. If not, stop the driver immediately and correct the problem. After the pump is delivering liquid, check the unit for excessive vibration, localized heating, and excessive shaft seal leakage. Check the pressure or vacuum by installing gauges at both the inlet and discharge sides of the pump to make sure the pressure or vacuum conforms to specifications.

5. INSTRUCTIONS FOR PUMP DISASSEMBLY

Refer to Section 7. **PUMP SECTIONAL DRAWINGS and SEALING OPTIONS.**

1. Read and understand all safety instructions and warnings before starting to disassemble pump. While disassembling pump, always inspect disassembled parts and adjacent parts to see if further disassembly is needed. Replace worn or damaged parts as required.
2. Turn off pump and lockout energy source to driver. **DO NOT** proceed further with disassembly of pump if there is the slightest possibility that driver may be started.
3. If used, turn off and disconnect fluid flush to packing or cartridge seal, if applicable.
4. Close inlet and discharge valves.
5. Remove guard and disconnect coupling of driver and pump.
6. Drain inlet and discharge lines. Disconnect lines from pump inlet and discharge.
7. Remove pipe plug [73] from inlet body [41]. Drain inlet body.
8. Remove reducer coupling [44] from rotor and stator kit [98] using a pipe wrench.
9. Remove two retaining screws [27] from shaft collar [25] using an Allen wrench.
10. Remove shaft pin [28] by pushing pin through and out of drive shaft [24] and shaft collar [25]. Slide shaft collar back to packing gland [36A] or cartridge seal [36B].
11. Remove two pin washers [26] from drive shaft [24].
12. Place a temporary support, such as a block of wood, under inlet body [41]. Remove two cap screws [B] securing stator support cap [43] to stator support [42]. Remove both cap and support.

13. Remove rotor and stator kit [98], and attached parts (connecting rod [31], connecting rod washers [32], etc.) by unscrewing stator from inlet body [41]. Either make a mark on drive end of rotor to correspond with face of stator or measure and record distance rotor extends from stator. This will be useful for reassembly.
14. Remove rotor [98 ROTOR] from stator [98 STATOR] using a twisting motion (similar to unthreading parts) may help ease rotor removal. **NOTE: Any fluid trapped in cavities formed by rotor and stator will spill from these parts during disassembly. Full precautions should be taken to avoid any hazards.**
15. Remove rotor band [30] from rotor [98 ROTOR]. Use a punch or dowel to tap rotor band from rotor. Take care not to tap or press on free end of connecting rod [31] as this may cause damage to it and rotor pin [29]. Remove rotor pin by pushing out of rotor and remove connecting rod.
16. Remove connecting rod washers [32] from connecting rod [31].
17. Remove drive key [A] from drive shaft [24]. Remove four cap screws [H], lockwashers [J], and bearing coverplate [10]. Remove lip seal [19] from bearing coverplate.
18. A. Loosen nuts [E] securing packing gland [36A] or cartridge seal [36B].
B. If cartridge seal contains clips, turn clips to lock the rotating collar to the stationary seat.
C. Loosen cartridge seal set screws that retains rotating collar to the drive shaft [24].
19. Carefully remove drive shaft [24] and attached parts (bearings [12, 13], spacer [14], lockwasher [15], and locknut [16]) from inlet body [41]. A dowel may be inserted into tubing end of drive shaft to tap upon to ease removal of shaft assembly. Make sure dowel fits inside of tubing and seats against solid part of drive shaft. **DO NOT** tap or press on tubing part of drive shaft as this may cause damage to part. Remove shaft collar [25] from opening in inlet body.
20. One tab of bearing lockwasher [15] should be found positioned into groove of bearing locknut [16]. Locate this tab and straighten it out of groove. Using a spanner wrench, remove bearing locknut and bearing lockwasher.
21. Press outer bearing [13], bearing spacer [14], and inner bearing [12] from drive shaft [24]. Be careful not to damage bearings or shaft. Press against inner race of bearings to avoid bearing damage. **DO NOT spin bearings with compressed air. This is highly dangerous and can cause bearings to fragment with explosive force, thereby possibly causing serious injury or death.**
22. Remove two nuts [E], and flat washers [F] from packing bolts [G].
A. Remove packing gland [36A].
B. Or carefully remove cartridge seal [36B] from opening in inlet body.
Warning: some cartridge seal components can be easily damaged.
23. If applicable, remove packing set [38], lantern ring [39], and packing gland washer [37] from inlet body [41]. Packing hooks are commercially available to assist in removing packing. With drive shaft [24] removed, a dowel may be inserted into threaded end of inlet body to press against packing gland washer, thereby pushing out packing set and other parts from inlet body.
24. Remove two cap screws [B] securing body support cap [23] to body support [22]. Remove body support cap. Remove inlet body [41] from body support and temporary support.
25. Remove lip seal [18] from inlet body [41].
26. Visually inspect all parts. Replace all worn or damaged parts before reassembling pump. It is recommended that new packing set [38], lip seals [18, 19], pin washers [26], and connecting rod washers [32] be installed each time pump is disassembled and reassembled. It is recommended the o-rings in the cartridge seal be replaced.

6. INSTRUCTIONS FOR PUMP ASSEMBLY

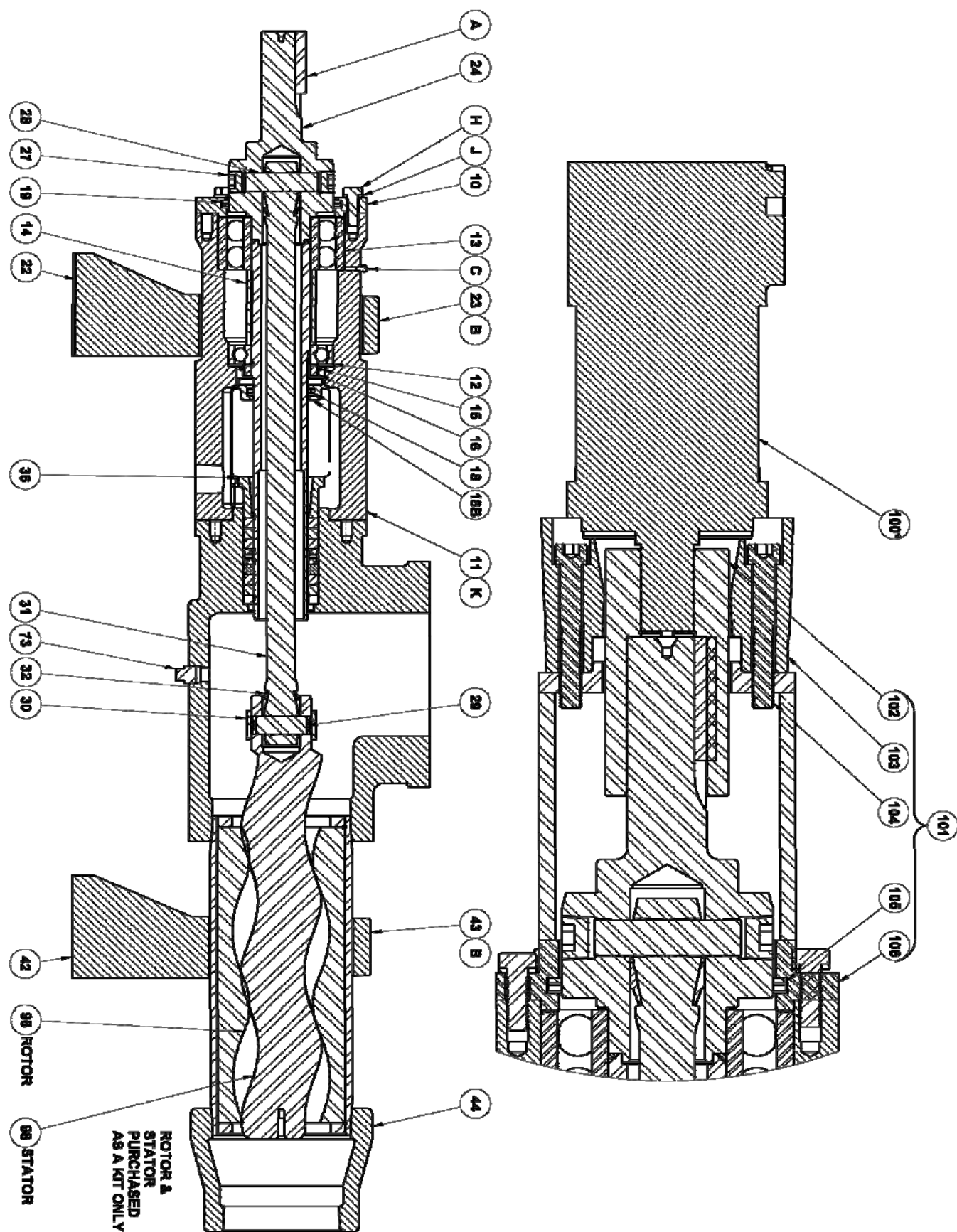
1. Read Sections 10, 11, and 12 on **SHAFT SEALING, BEARING LUBRICATION, and JOINT LUBRICATION** before assembling pump. Visually inspect all parts during assembly. Replace all worn or damaged parts. Although they may appear reusable, it is recommended that new packing set [38], lip seals [18, 19], pin washers [26], and connecting rod washers [32] be installed when pump is being reassembled. If a cartridge seal is used it is recommended the o-rings be replaced.
2. For ease of assembly, stand inlet body [41] vertically on end with threaded hole.
3. Install pipe plug [73] into inlet body [41].
4. A. Clean bore of stuffing box in inlet body [41]. Install packing gland washer [37] into inlet body. Install packing set [38] and lantern ring [39] into inlet body. Position lantern ring so that it aligns with flush holes in inlet body. Stagger joints of adjacent packing rings 180° apart. Refer to Section 10. **SHAFT SEALING**, for additional information.

B. If a cartridge seal is being used insure the rotating collar set screws will not interfere with the drive shaft installation. Apply a light film of grease to o-rings on the ID of the seal.
5. Install two packing bolts [G] into slots on sides of inlet body [41]. Place packing gland [36A] or the cartridge seal [36B] over bolts. Install two flat washers [F] and nuts [E] onto bolts. Only tighten nuts finger tight. Final tightening and packing adjustment should be done after pump has been completely assembled and installed. Refer to Section 10. **SHAFT SEALING**.
6. Install lip seal [18] into inlet body [41]. Lubricate bore of lip seal with light oil.
7. Place shaft collar [25] on top of packing gland [36] or cartridge seal [36B] to allow drive shaft [24] to pass through.
8. Press inner bearings [12], spacer [14], and outer bearing [13] onto drive shaft [24]. Be careful not to damage bearings or shaft. When pressing on bearings use an arbor or dowel to fit inside tubing section of shaft to apply pressure to solid part of shaft. **DO NOT** press against tubing section of shaft as this could damage shaft. Press against inner race of bearings to avoid bearing damage. **DO NOT spin bearings with compressed air. This is highly dangerous and can cause bearings to fragment with explosive force, thereby possibly causing serious injury or death.**
9. Install bearing lockwasher [15] onto drive shaft [24]. Install bearing locknut [16] onto drive shaft using a spanner wrench to tighten locknut. After tightening locknut onto shaft, locate groove in locknut that aligns with tab on lockwasher. If none are in alignment, additional tightening of locknut will be required. After aligning groove in locknut with tab on lockwasher, bend aligned tab of lockwasher into groove of locknut to prevent loosening of locknut.
10. Pack each bearing [12, 13] full of grease and fill space between bearings about one-half full of grease. Refer to Section 11. **BEARING LUBRICATION**, for additional information.
11. Lightly lubricate bore of packing set [38A] or cartridge seal [38B] o-rings. Carefully slide drive shaft [24] into inlet body [41] until outer bearing [13] seats. Make sure shaft collar [25] is present and that drive shaft passes through it. It may be necessary to lightly tap end of drive shaft with a rubber or plastic mallet to seat outer bearing. **DO NOT** use a metallic-faced striking instrument.

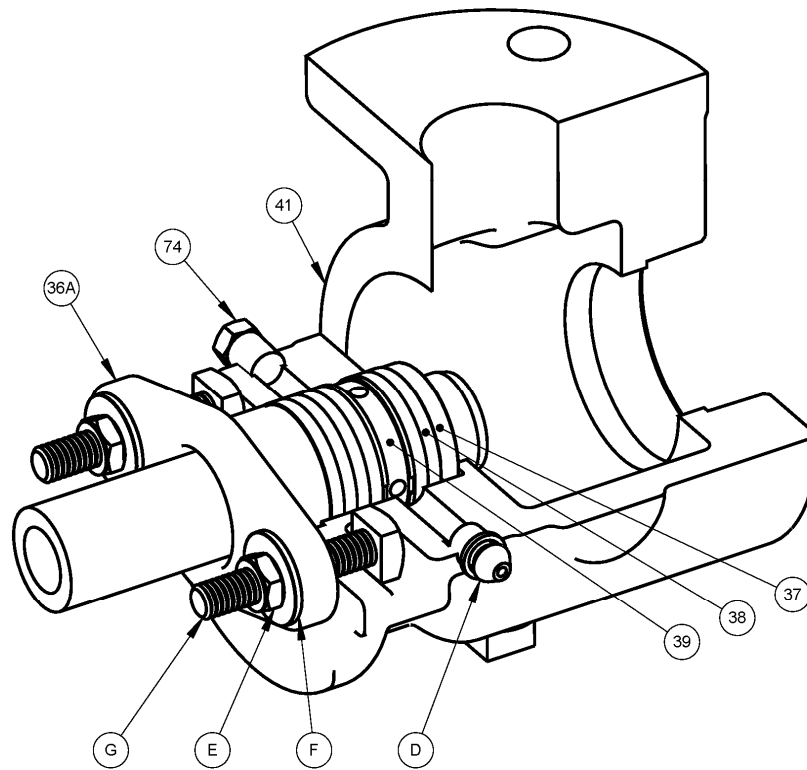
When the cartridge seal [38B] is used, lightly tighten the set screws evenly. This will center the cartridge seal rotating collar to the drive shaft. Tighten the nuts [E] onto the studs [G]. Then tighten the set screws. If cartridge seal contains clips, turn clips to release the rotating collar from the stationary seat.
12. Install lip seal [19] into bearing coverplate [10]. Lubricate bore of lip seal [19] with light oil.
13. Carefully install bearing coverplate [10], with lip seal [19], onto inlet body [41] taking care not to cut or damage lip seal on keyway of shaft [24]. Covering keyway with a piece of tape should help prevent damage to lip seal. Secure bearing coverplate using four cap screws [H] and lockwashers [J].
14. Lubricate and install two connecting rod washers [32] onto connecting rod [31].

15. Apply a generous amount of grease that is compatible with pumped fluid to one end of connecting rod [31]. Refer to Section 12. **JOINT LUBRICATION**, for additional information. Slide greased end of connecting rod into head of rotor [98 ROTOR] until pin holes are aligned. Install rotor pin [29] into rotor and connecting rod. Press or tap rotor band [30] onto rotor.
16. Lubricate inside of stator [98 STATOR] and profile of rotor [98 ROTOR] with glycerin, waterless hand cleaner or very soapy water. Grease or oil may also be used for this purpose when compatible with the pumped fluid. **Proceed with caution as both rotor and stator will be slippery and possibly difficult to hold.** Slide rotor into stator until mark on rotor aligns with face of stator or until rotor extends from stator the same amount as measured previously. Refer to Step 13 in Section 5. **INSTRUCTIONS FOR PUMP DISASSEMBLY**. Immediately clean up any material used for lubricating parts that may have spilled.
17. Apply a generous amount of grease that is compatible with pumped fluid to free end of connecting rod [31]. Refer to Section 12. **JOINT LUBRICATION**, for additional information.
18. At this point, inlet body assembly should be positioned to a horizontal position and secured to prevent movement.
19. Refer to Section 13. **NPT CONNECTIONS**. Start threads of stator [98 STATOR] into inlet body [41]. Position free end of connecting rod [31] in drive shaft [24] until pin holes are aligned.
20. Install one pin washer [26] into counterbore on each side of drive shaft [24]. Slide collar [25] over pin washers and pin holes in shaft.
21. Install shaft pin [28] through collar [25], pin washers [26], drive shaft [24], and connecting rod [31]. Shaft pin should extend evenly from both sides of shaft pin holes.
22. Install two retaining screws [27] into collar [25], over pin washers [26], using an Allen wrench. Make sure pin washers are not cocked in their counterbores in shaft [24]. Also, make sure counterbores in retaining screws fit over extensions of shaft pin [28], and pilot of retaining screws fit into counterbores of shaft. This will help insure proper sealing of shaft pin.
23. Fully tighten stator [98 STATOR] into inlet body [41] using a pipe wrench. Position wrench close to inlet body to reduce stresses imposed on threads while tightening.
24. Refer to Section 13. **NPT CONNECTIONS**. Install reducer coupling [44] onto stator [98 STATOR].
25. Set assembly on body support [22] and stator support [42]. Place body support cap [23] and stator support cap [43] in position and secure with four cap screws [B]. Tighten cap screws evenly to secure support caps. *Excessive or uneven tightening of cap screws may damage or break support caps.*
26. Install drive key [A] into drive shaft [24].
27. Read and understand all safety instructions and warnings, Section 1. **WARNINGS & GENERAL GUIDELINES**, Section 4. **PREOPERATION CHECKS**, Section 10. **SHAFT SEALING**, and make sure to follow Section 3. **MAXIMUM PRESSURE RATINGS** before installing and operating pump.

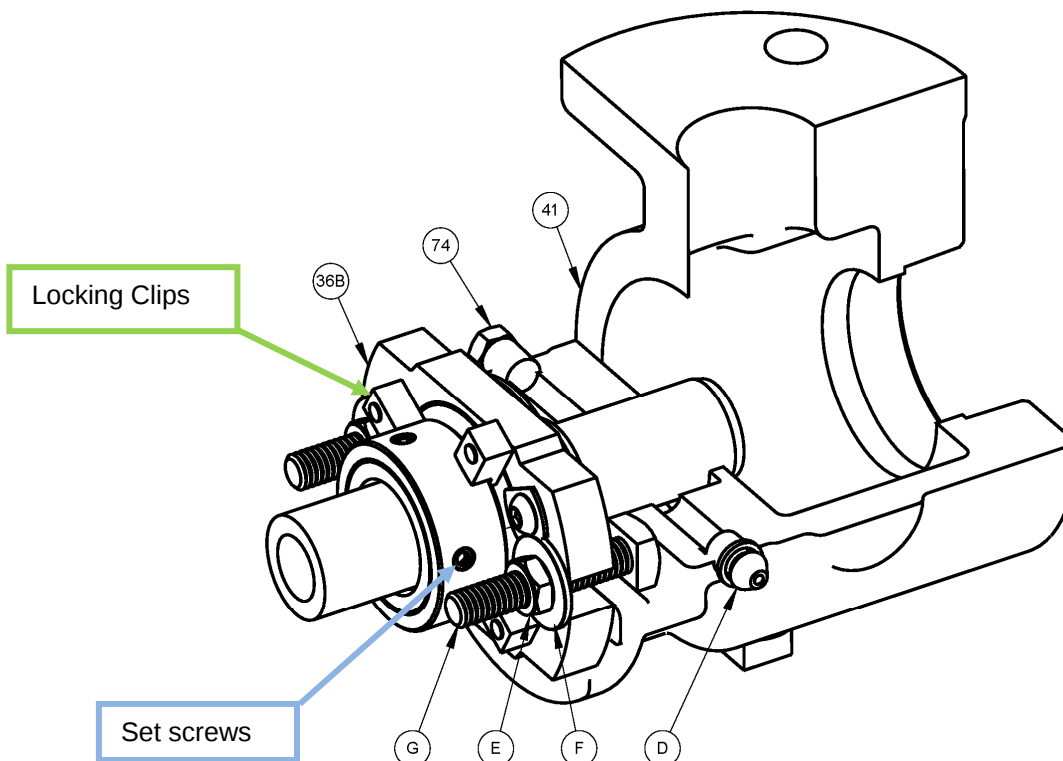
7. PUMP SECTIONAL DRAWINGS



SEALING OPTION A: Packing



SEALING OPTION B: Cartridge Seal



Typical Cartridge Seal: Replaces packing gland [36A] and items [37], [38], and [39].

8. PARTS LIST

Refer to the drawing in Section 7.

Asterisk (*) denotes recommended spare parts.

XERIC rotors and stators are only sold as a kit. The stator is not interchangeable with any standard rotor.

KEY NO.	DESCRIPTION	QTY.	PUMP	IRON/STEEL	STAINLESS
10	Bearing Coverplate	1	ALL	P92-5	
11	Bearing Housing	1	ALL	P96-5	
12	Bearing, Inner	1	ALL	G40-139	
13	Bearing, Outer	1	ALL	G40-175	
14	Bearing Spacer	1	ALL	D101-10	
15	Bearing Lockwasher	1	ALL	G33-30	
16	Bearing Locknut	1	ALL	G33-29	
18*	Lip Seal, Inner	1	ALL	G17-98	
18B	Retainer, Lip Seal	1	ALL	P92-7	
19*	Lip Seal, Outer	1	ALL	G17-97	
22	Body Support	1	ALL	P94-10	
23	Body Support Cap	1	ALL	P95-10	
24	Drive Shaft	1	ALL	D98-28	D98-33
27*	Pipe Plug	4	ALL	G56-25	
28*	Pin, Shaft	1	ALL	D99-10	D99-22
29*	Pin, Rotor	1	ALL	D99-9	D99-21
30	Rotor Band	1	ALL		D101-9
31*	Connecting Rod	1	ALL	D97-5	D97-11
32*	Connecting Rod Washer	2			
	(NBR)		ALL	G90-5	
	(FKM)		ALL	G90-11	
	SEALING OPTION A				
36A	Packing Gland	1	ALL	CP91-5-24	CP91-5-25
37	Packing Gland Washer	1	ALL	D102-5	D102-11
38*	Packing Set (Synthetic)	1	ALL	N43-60	N43-92
39	Lantern Ring (TFE)	1	ALL	D103-5	
	SEALING OPTION B				
36B	Triple Lip Cartridge Seal	1	ALL	G4-539	
41	Inlet Body	1	ALL	P90-5	CP90-5
42	Stator Support	1-2	ALL	P94-9	
43	Stator Support Cap	1-2	ALL	P95-9	
44	Reducer Coupling	1	ALL	P93-5	CP93-5
73	Pipe Plug, 1/2" NPT	3	ALL	G56-58	G56-46
74	Pipe Plug, 1/8" NPT	1	ALL	G56-45	G56-53

KEY NO.	DESCRIPTION	QTY.	PUMP	IRON/STEEL	STAINLESS
98*	Stator Kit	1			
			91219	N100-100	
			92219	N100-104	
			91228	N100-102	
			92228	N100-113	
100*	Hydraulic Motor	0	ALL	*SEE NOTE	
101	Hyd. Motor Bracket Kit	1			
	SAE B, 4 Bolt		ALL	N47-133	
102	Rigid Coupling	1	ALL	D31-238	
103	Hyd. Motor Bracket	1	ALL		
	SAE B, 4 Bolt			P22-164-18	
104	Mounting Bolts	4	ALL	G45-050350	
105	Lip Seal	1	ALL	G17-97	
106	Pump Adapter	1	ALL	P22-220	

KEY NO.	DESCRIPTION	QTY.	PUMP	PART NO.	SIZE
A	Key, Drive	1	ALL	D30-152	1/2" sq X 3"
B	Screw, Hex Head	8-12	ALL	G50-050350	1/2"-13 X 3-1/2"
C	Lube Fitting, Drive	1	ALL	G63-1	3/16" drive
D	Lube Fitting, Threaded	1	ALL	G63-2	1/8" NPT
E	Nut, Hex	2	ALL	G73-0500	1/2"-13
F	Washer, Flat	2	ALL	G8-337	1/2"
G	Stud	2	ALL	D22-217 *for Packing	1/2"-13 X 4-1/2"
	Stud	2	ALL	D22-249 *for Cartridge Seal	1/2"-13 X 3-1/4"
H	Screw, Hex Head	5	ALL	G50-050150	1/2"-13 X 1-1/2"
J	Lockwasher	5	ALL	G8-340	1/2"
K	Screw, Hex Head	4	ALL	G50-075200	3/4"-10 X 2"
IOM	Instruction Manual	1	ALL	G12-583	

9. STORAGE

If you do not intend to install this Roper pump within the time frame specified below, the following recommendations are offered and should be followed to insure the best possible chances of a successful startup when the pump is installed.

SHORT TERM STORAGE (up to six months)

The following recommendations are offered for storage of up to six months:

- Protect the pump from the elements. Store the pump indoors whenever possible away from sources of ozone-generating equipment such as motors or generators. If indoor storage is not possible, cover the pump with a protective covering. Do not allow moisture to collect in or around the pump.
- Remove the drain plug from the inlet housing and allow the pump to dry completely.
- Relieve the compression on the packing by loosening the packing gland. If you intend to grease lubricate the packing after installing the pump, inject a liberal amount of grease into the stuffing box through the lube fitting. If a water flush is to be used, do not inject grease into the stuffing box; instead, place a small amount of light oil into the stuffing box.
- Read and understand this manual thoroughly before installing or starting pump.

LONG TERM STORAGE (over six months)

If the pump is to be in storage for over six months, follow both the recommendations above for short term storage and the following recommendations:

- If applicable, remove the drive belts from belt-driven units or disconnect the coupling on direct-connected units.
- Apply a rust inhibitor to the pump. Since the stator is metal, it is subject to rust. Applying oil can prevent corrosion and increase longevity of pump life. Approximately every two weeks, rotate the drive shaft of the pump manually for several revolutions.

If other equipment included with the pump, such as drivers, seals, flow monitors, etc., is to be stored also, refer to the respective manufacturer's recommendations for storage.

10. SHAFT SEALING

PACKING

The standard shaft sealing method used in these pumps is die-formed ring packing with a lantern ring. Tapped holes on each side of the inlet body provide access to the lantern ring for either water flushing or grease lubrication. A water flush or lubrication of the packing is necessary for proper operation and will help prolong the life of the packing and shaft.

Water flushing is recommended when the fluid to be pumped is abrasive or the pump is operated with negative inlet pressure (suction lift). Clean water should be supplied to the stuffing box at a rate of $\frac{1}{4}$ to $\frac{1}{2}$ gallon per minute. The pressure of the flushing water should be approximately 10 to 15 psi higher than the pressure of the fluid in the inlet body.

NOTE: On applications where clean water is not available or where it is incompatible with the fluid being pumped, other clean, non-hazardous liquids may be used for flushing the packing.

If the packing is to be grease-lubricated, a good grade of bearing grease should generally be used. Should bearing grease be unacceptable or incompatible with the fluid being pumped, another paste-type lubricant may be used. Lubrication of the packing must be performed with the pump stopped. Before daily start-up, if applicable, is a good time. **DO NOT** lubricate or adjust packing with the pump operating. To lubricate the packing, stop the pump and carefully clean the lube fitting and pipe plug of any contaminants. After removing the pipe plug from the side of the stuffing box, lubricant may be injected into the stuffing box through the lube fitting on the other side. Inject clean, fresh unused lubricant until it is seen coming out of the unplugged hole. Clean up any expelled lubricant and the lube fitting. Replace the pipe plug. This procedure should be performed daily, prior to start-up. In certain applications, more frequent lubrication of the packing may be necessary. Experience will provide a guide as to how frequently the packing should be lubricated. Applying lubricant often will extend the life of the packing and shaft.



WARNING

WHERE LIQUID BEING HANDLED IS HAZARDOUS OR VOLATILE, FULL PRECAUTIONS SHOULD BE TAKEN AT ALL TIMES INCLUDING THE RUN-IN PERIOD.

DO NOT work on a pump while it is operating.

CARE OF PACKING

Packing hooks are commercially available to help in removing packing rings from the stuffing box. It is generally not recommended to reuse old packing rings. When installing packing, use formed packing rings. **DO NOT** use a one-piece spiral wrap of packing. Before installing packing, carefully clean the stuffing box and shaft.

Packing rings should be installed one ring at a time, with the joints of adjacent rings staggered approximately 180°. Each ring should be seated firmly before the next ring is installed. **DO NOT** forget to install the lantern ring. The lantern ring should be approximately aligned with the two flush/lube holes in the stuffing box.

The packing gland nuts should first be evenly tightened with a wrench to seat the packing firmly in the stuffing box and against the shaft, then backed off until finger-tight. Connect the flush or lubricate the packing, depending upon the method used. After the pump is started, note the amount of leakage from the stuffing box. If the packing leakage exceeds ten drops per minute, stop the pump and adjust the gland nuts. The gland nuts should be adjusted evenly in $\frac{1}{6}$ to $\frac{1}{3}$ turn (1 to 2 flats on the nut) increments. Start the pump and allow it to operate for several minutes. Again, visually examine the stuffing box for excessive leakage. Repeat the above procedure until the stuffing box leakage is between five to ten drops per minute.

DO NOT over-tighten the packing. Slight leakage is a necessary requirement for proper packing operation. Leakage of five to ten drops per minute when the pump is operating is desirable, as it will preserve the packing and avoid scoring of the shaft. Over-tight packing may score shafts, increase torque requirements of the pump, damage couplings and drivers, and generate excessive heat.

The pump should be stopped and the packing gland adjusted whenever leakage exceeds ten drops per minute. The condition of the packing should be checked at regular intervals, the frequency depending on the type of service. Experience will dictate how frequently the inspections should be made.

MECHANICAL SEALS

Certain applications may not permit the necessary leakage required for the proper operation of packing. These applications may require the use of an end-face type of mechanical seal. Various types of mechanical seals may be available to fit most pumps. Due to the various seal types and styles available, the seal manufacturer's instructions for installation and setting should be followed.

CARTRIDGE SEALS

Certain applications may not permit the necessary leakage required for the proper operation of packing or mechanical seals. Applications where the pumping fluid has particles that are abrasive and/or encounters high temperature (250°F to 400°F) may require cartridge seals. Follow the seal manufacturer's instructions for installation and setting.

NOTE: Not all seals will fit or function in all pumps. Modification to the pump and/or seal may be required, or it may be necessary to change to a different type of seal. Consult with both the pump and seal manufacturers if a change in shaft sealing method appears necessary.

11. BEARING LUBRICATION

The pump bearings are antifriction bearings, either ball bearings or tapered roller bearings, and are grease lubricated. The bearings installed in pumps are lubricated at the factory and, under normal operating conditions, should not need additional lubrication or re-lubrication for the first 10,000 hours of operation. When the pump is operated in dusty or moist environments, the lubrication intervals should be shortened.

A good grade of NLGI Grade 2 EP (extreme pressure) grease, suitable for the operating temperatures encountered, should be used. Pumps are lubricated at the factory..

It is recommended that the bearing seals be replaced each time the pump is re-lubricated. Add a few drops of oil to the bore of the bearing seals before reassembling.

PREFERRED RE-LUBRICATION METHOD

When re-lubricating the bearings, the shaft-bearing assembly should be removed from the pump and cleaned of old lubricant. See Section 5. **INSTRUCTIONS FOR PUMP DISASSEMBLY**. Carefully inspect the bearings for signs of wear or contamination and replace them if necessary. **DO NOT** contaminate the bearings while they are out of the pump. Pack each bearing full of grease and fill the space between the bearings approximately one-half full.

ALTERNATE RE-LUBRICATION METHOD

The following alternate re-lubrication method is provided as a convenience for installations where the pump location creates extreme difficulty in using the preferred re-lubrication method. Bearing life may be reduced as any existing contaminants are not removed. Thoroughly clean the lube fitting found in the bearing area of either the bearing housing or inlet body. Inject approximately 1 to 1-1/2 ounces of grease into the bearing area through the lube fitting. Clean any excess grease from around the fitting to avoid attracting dirt and contaminants.

When using the alternate re-lubrication method, it is recommended that every second or third re-lubrication of the pump be performed using the preferred re-lubrication method. This will allow proper cleaning and inspection of the parts to be performed.

NOTE: In a new or re-lubricated pump, the bearings may run warmer than normal for a few hours before the temperature levels to normal operating temperature. This is a normal condition of bearings freshly lubricated and is no cause for alarm. Higher than normal bearing temperature, occurring for several days after re-lubricating the bearings, may indicate a problem. This problem could be an excessive amount of lubricant, a contaminated bearing, or it could possibly indicate a bearing about to fail. Should bearing temperatures run higher than normal for several days, it is recommended that the shaft-bearing assembly be removed, inspected, and re-lubricated as outlined in the preferred re-lubrication method.

WARNING

DO NOT spin bearings with compressed air. This is highly dangerous and will cause the bearing to spin at dangerously high speed. This can cause the bearing to fragment with explosive force possibly causing serious personal injury or death.

To insure that antifriction bearings are capable of achieving long life and that they perform without objectionable noise, temperature rise, or shaft excursions, the following precautions are recommended:

- Handle bearings with care.
- Work with clean tools, clean dry hands, and in clean surroundings.
- **DO NOT** wash or wipe new bearings prior to installation.

- Place unwrapped bearings on clean paper and keep them similarly covered, if they are not in the original container.
- **DO NOT** use wooden mallets, brittle or chipped tools, or dirty fixtures and tools in mounting bearings.
- **DO NOT** spin bearings that have not been cleaned. **NEVER** spin any bearing with compressed air.
- **DO NOT** scratch or nick bearings.
- Insure that races are started onto shafts and into housings evenly so as to prevent cocking.
- Inspect shafts and housings before mounting bearings.
- When removing bearings, clean housings, covers, and shafts before exposing the bearings. All dirt can be considered an abrasive – dangerous to the reuse of any bearing.
- Treat used bearings, which may be reused, as new ones.
- Protect dismantled bearings from dirt and moisture. Wrap bearings in clean oil-proof paper when not in use.
- In assembling bearings onto shafts, **NEVER** strike the outer race, or press on it to force the inner race. Apply pressure to the inner race only. In disassembling, follow the same precautions.

The general classifications of failures and deficiencies requiring bearing removal are listed below. These classifications are associated with numerous causes, some of which are outlined as follows.

PROBLEM	POSSIBLE CAUSES
OVERHEATING	Bearing contamination
	Excessive lubrication
	Inadequate lubrication
	Housing distortion
	Cage wear
VIBRATION	Bearing contamination
	Fatigued bearing elements
	Race misalignment
	Shaft out-of-round
	Flats on bearing elements
NOISE	Inadequate lubrication
	Bearing contamination
	Brinelling due to handling abuse
	Loss of bearing clearance
	Bearing slipping on shaft
BINDING	Lubricant breakdown
	Bearing contamination
	Thermal expansion
	Race misalignment
	Cage failure
LUBRICANT LEAKAGE	Excessive lubrication
	Seal wear or failure
	Lubricant deteriorating due to high temperature
	Lubricant churning

12. JOINT LUBRICATION

This pump is provided with two universal joints which allow the rotor to rotate through an eccentric path necessary to the proper functioning of the pump. The joints may be of a pin type or crowned gear type depending upon the model of the pump. Proper lubrication of the joints is important and will help extend the service life of the joint components.

When assembling the pump, make sure that all components of the joint are coated with lubricant. Also, fill the spaces between joint components full of lubricant. This is particularly important because joint lubrication can be performed only when the pump is disassembled, and the lubricant must perform its job until the next time maintenance is performed on the pump.

In pin joint pumps, use a grease that is compatible with the fluid being pumped and that will not react with the fluid. In gear joint pumps, a good grade of EP (extreme pressure) grease containing molybdenum disulfide additives should be used.

13. NPT CONNECTIONS

American National Standard Taper Pipe Treads (NPT) are used on pipe plugs, threaded stator connections, and threaded ports of the pump. To produce a pressure-tight joint, a thread sealant must be used. TFE tape is generally not recommended where cast iron is used as one or more parts of the joint. The use of TFE tape for installing cast iron fittings may cause damage to the pump or fittings.

The following is a partial list of sealants that may be used when making up joints on the pump.

For cast iron or steel joints:

- PST Pipe Sealant No. 567 – Loctite Corp.
- Rectorseal No. 5 – The Rectorseal Corp.
- Leak Lock – Highside Chemical, Inc.

For stainless steel joints:

- PST Pipe Sealant No. 567 – Loctite Corp.

Follow the sealant manufacturer's instructions when making up a joint.

NOTE: The assembly of NPT connections, especially on stainless steel, without the use of a sealant may cause severe galling of the threads resulting in damaged parts that may require replacement.